Chemistry 201
Practice Name_____

Part One: Multiple Choice (40 points)
Select the best answer to each question. There is only one correct answer.

1. Which quantum number distinguishes the different shapes of the orbitals?
   a. n, principal b. l, azimuthal c. m_l, magnetic d. s, spin e. none do

2. Which quantum number determines the size of an orbital shell?
   a. n, principal b. l, azimuthal c. m_l, magnetic d. s, spin e. none do

3. An orbital can hold at most _____ electrons.
   a. 2 b. 8 c. 18 d. 32 e. depends on the orbital

4. Which element has the highest electronegativity?
   a. oxygen b. sodium c. bromine d. sulfur e. hydrogen

5. What is the bond order of the nitrogen molecule?
   a. zero b. one c. two d. three e. four

6. Which atom has the largest atomic radii?
   a. potassium b. calcium c. arsenic d. bromine e. they are the same

7. Which group forms oxides of the formula R_2O?
   a. halogens b. chalcogens c. noble gases d. alkali metals e. alkaline earth metals

8. Which of the following electron pair arrangements consists of 109.5 degree bond angles?
   a. octahedral b. trigonal planar c. linear d. tetrahedral e. none of these

9. Which hybridization occurs around the carbons in CH_2CH_2 (ethylene)?
   a. sp^3 b. sp^2 c. sp d. no hybridization

10. How many different "*shapes*" (values of quantum number l) are possible for n=7?
    a. 4 b. 5 c. 6 d. 7 e. 8

11. How many unpaired electrons are in selenium
    a. 0 b.1 c. 2 d. 3 e. 4

12. When an atom gains an electron and becomes an anion it:
    a. gets bigger b. gets smaller c. does not change size

13. Which of the following molecules is a notable exception to the octet rule?
    a. ammonia b. methane c. carbon dioxide d. boron trifluoride e. water

14. Which of the following molecules has the shortest bond length?
    a. fluorine b. oxygen c. nitrogen d. they are the same

15. Which of the following molecules is polar?
    a. carbon dioxide b. sulfur hexafluoride c. carbon tetrachloride d.nitrogen dioxide

16. Which of the following species is non-linear?
    a. NO_2^+ b. CS_2 c. OCN^{1-} d. SO_2 e. CO_2

17. Which pair is isoelectronic (having the same number of electrons)?
    a. Na^{1+}, K^{1+} b. Cl^{1-},F^{1-} c. Ca^{2+},Mg^{2+} d. Al^{3+}, Ne e. P^{1-}, Ca^{1+}

18. All of the following have noble gas electronic configurations except:
    a. Cl^{1-} b. N^{3-} c. Mg^{2+} d. P^{3+} e. Ar

19. Which name is associated with the rule that states no two electrons can have the same exact set of quantum numbers?
    a. Pauli b. Hund c. Heisenberg d. Rutherforde. Aufbau

20. As the frequency of electromagnetic radiation increases its energy:
    a. increases b. decreases c. remains constant d. fluctuates

Part Two: Short Answer (24 points)
Write your answer in the space provided

1. Explain the difference between ionization energy and electron affinity.

2. What are the four quantum numbers and what does each represent?

3. What does VSEPR mean – briefly state this theory.

4. Consider the molecules PF_5 and NF_5. One is stable and one is not. Which one is which and why?

5. Consider the molecules C_2H_4 and Si_2H_4. One is stable and one is not. Which one is which and why?

6. What causes line spectra?

Part Three: Molecular Structure (36 points)

For each central atom in each molecule – fill in the requested information:

Molecule	**Lewis Dot Structure**	**Arrangement of Pairs**	**Shape (Molecular Geometry)**	**Polar (P) or Non-Polar (N)**
$CHCl_3$				
HCN				
BF_3				
ICl_4^{1-}				
N_2H_4				
PF_5				
ICl_3				
C_2H_4				
NO_3^{1-}				